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PATENT SPECIFICATION

DRAWINGS ATTACHED

888,143

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Index at acceptance:—Classes 99(1), G(18E:24E2), J3E; and 135, VE1C1, VM1C5B.

International Classification:—F06l. F06k.

COMPLETE SPECIFICATION

Improvements in or relating to Fittings and Valves having parts made of Plastics Material

We, REGIE NATIONALE DES USINES RENAULT, a French Body Corporate, of 8/10, Avenue Emile Zola, Billancourt (Seine), France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to fittings such as couplings, valves and cocks, for use in fluid distribution systems including pipes, tubes and hoses.

According to the present invention there is provided a fitting for use in fluid distribution systems including pipes, tubes and/or hoses, said fitting comprising a female member and formed with a frusto-conical seat surface, a male member made of plastics material and having a flexible annular end portion terminating in a beveled annular lip freely engageable with said seat surface, said lip having a free end adapted to abut axially against an intermediate portion of said seat surface, and tightening means for coupling said members and simultaneously subjecting the lip to an elastic flexion with the end of said lip being constricted in a sealing relationship by and with the seat surface.

The fitting may include means for positively limiting insertion of the male member into the female member thereby to determine the optimum position of the beveled annular lip against and relative to the seat surface with which it is adapted to coact.

With the arrangement broadly set forth hereinabove, the sealing action that can thus be obtained is not subordinate to a more or less pronounced tightening effort (which may even be relatively low since a manual tightening is sufficient) so that the fitting may be disassembled or actuated as many times as desired or necessary without or with little risk of impairing the efficiency of the seal.

Preferably, the fittings are made entirely of plastics material. The use of plastics material has considerable advantages such as an extremely accurate fabrication of the parts to the requisite dimensions, the suppression of any machining step, the elimination of any risk of corrosion by, for example, atmospheric agents and moisture, a long useful life, an easy assembling and disassembling, the reduction of manpower cost, the elimination of packing gaskets or other intermediate elements employed in conventional fittings, very low manufacturing cost, low weight, and consequently low equipment weight.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made to the accompanying drawings, in whlich:—

Figure 1 is a half axial section of a first form of coupling, for connecting two pipes or hoses, according to the invention;

Figure 2 is a half axial section of the second form of hose or pipe coupling according to the invention;

Figure 3 is an axial section of a third form of hose or pipe coupling according to the invention;

Figure 4 is a fragmentary axial section of a fourth form of pipe or hose coupling according to the invention;

Figure 5 is an elevational, part sectional view showing a typical application of different forms of fittings constructed in accordance with the invention;

Figure 6 is an axial section of a valve or cock particularly suitable for connection in a flexible-hose distributing line; and

Figures 7 and 8 are sections of two forms of valves or cocks which are particularly suitable for connection in a fixed and rigid pipe distribution line.

The pipe or hose coupling shown in Figure 1 comprises a female member 1 and a male

member 2, both made of a plastics material. The female member 1 is formed on the side engageable by a male member 2 with a widened, cup-shaped inner portion comprising a seat-forming frusto-conical surface 3 adapted to be engaged by an internally beveled sealing lip 4^1 of a sealing annular portion 4 of the male member 2 when the coupling is tightened.

This annular sealing portion 4, before the fitting is assembled and tightened, has substantially the shape shown in the lower half of Figure 4 showing a coupling based on the same principle, the outer diameter of the annular sealing portion 4 being slightly less than the inner diameter of the tubular end portion 5 of the female member.

Thus, when the coupling is tightened, the annular sealing portion 4 is urged with a certain elastic tension against the seat-forming surface 3 and its beveled end lip 4^1 acts as an efficient sealing lip, the sealing action of this lip being furthermore enhanced by fluid pressure when present in the coupling. Due to the deformation of the annular portion 4 that takes place during tightening of coupling members 1 and 2, the outer peripheral surface of portion 4 may even come to engage the inner wall of the portion 5 of the female member, but this is but a secondary sealing action which is not only unnecessary but is likely to interfere with the sealing action between lip 4^1 and surface 3, as this additional contact would tend to reduce the pressure with which the lip 4^1 engages the seat 3.

In order to couple the female and male members 1 and 2, there is provided a union-nut 6 which is adapted to be screwed onto a threaded portion of the female member and which comprises an inner flange 6^1 adapted to engage an annular shoulder 7 formed on the male member 2 and to fit around the body of this member 2 with a slight clearance 8. The nut 6 has its outer surface 9 knurled or milled so that it can easily be screwed and tightened by hand, for the tension ensuring the proper sealing engagement of the annular portion 4^1 with the seat 3 can be obtained by rotating the nut manually.

The end portion 5 of female member 1 has a bevelled edge adapted to abut against the leading surface of shoulder 7 when the annular sealing portion 4 is properly positioned relative to the co-acting seat 3; with this arrangement, it is possible to avoid any undue over-tightening while ensuring very simply the desired fluid-tightness under the best possible conditions of sealing engagement of the annular portion 4.

The female and male members of this coupling are formed in the Figure 1 embodiment with neck or collar portions 12 and 13 for receiving internally one end of each of two pipes or hoses 10 and 11, which ends are secured by welding or glueing to portions 12 and 13. These neck or collar portions have formed on their inner surface, a plurality of circular grooves 14 in which the glue or other adhesive substance will form, after setting, a corresponding plurality of shoulders or beads which serve to help resist undesired stripping of pipes or hoses 10 and 11. The nut 6, loosely carried by the male member 2, makes it extremely easy and simple to uncouple the pipes from each other when necessary.

Figure 2 shows a coupling similar to that in Figure 1 but in which the pipes or hoses 10 and 11 are secured by glueing on the outer instead of the inner surface of the neck or collar portions which are accordingly formed with external grooves for the purpose set forth in the preceding paragraph.

In the hose or pipe coupling shown in Figure 3, the female member 1 is similar to that shown in Figures 1 and 2, but the male annular sealing portion consists in this case of the end portion 15 of the hose proper, this end portion being swelled for this purpose by inserting therein an outwardly bulbiform annulus 16 whose inner end portion is elongated to facilitate its insertion into the hose end portion 15 and has a series of circular steps 17 adapted to prevent undesired escape of the annulus hose end portion. Coupling is effected by means of an internally threaded collar or nut 18 formed with an integral inner flange 18^1 of an inner diameter slightly greater than the normal outer diameter of the hose, the nut 18 being engaged on the hose end portion 15 before inserting the annulus 16 therein. This nut is then screwed on the female member 1, presses the free bevel-like lip 15^1 of the swelled end portion against the seat surface 3, and subjects the free lip 15^1 to an elastic flexion with the end of the lip being constricted by the seat surface 3 into a sealing relationship therewith. When fluid under pressure is present in the coupling, the sealing action induced by the elastic tension, to which the free lip 15^1 and its end are subjected, is enhanced by the fluid pressure which acts on the exposed surfaces of the lip.

The annulus 16 has at its front end an annular, projecting tip 16^1, which engages the end portion 15 of the hose rearwardly of the lip 15^1. This tip 16^1, which participates in the sealing action between the lip 15^1 and the seat surface 3, does not however interfere with the freedom of the lip 15^1 to be subjected to elastic flexion and to be subjected to the action of the fluid pressure when present in the coupling.

It will be understood that the hose coupling shown in Figure 3 is completely symmetrical, the other hose (not shown) being secured in the same manner.

The nut 18 may be made of metal or plas-

tics material, this last solution being more economical.

This embodiment is particularly advantageous in that it eliminates any glueing or welding steps; however, it requires the insertion of an annulus 16 in each of the hose ends to be coupled.

In the form of coupling shown in Figure 4, the female member 1 of the coupling may be any one of those utilized in the preceding embodiments and receives the male portion of a reducer 19 which comprises an annular sealing portion 4 and fits in the member 1 under the same conditions as those indicated in connection with the pipe fitting of Figure 1, except that the screw collar or nut 6 is formed integrally with the member 19. This member 19 is furthermore provided with a reduced female portion 20 to provide for coupling with a hose of reduced diameter, not shown, according to one or the other of the two kinds of connection described hereinabove and shown in Figures 1 and 3.

The female member 1, which is shown only partially in Figure 4, may alternatively form an integral part of a T, Y, cross or like element.

Figure 5 illustrates a practical application of different forms of fittings constructed according to this invention in connection with a double-acting pneumatic distributor 21 controlled by electromagnetic or solenoid relay valves 22 and adapted for example to distribute compressed air from a network to the two sides of a pneumatic cylinder (not shown).

The reference numeral 23 designates the pipe through which the compressed air is supplied. This pipe is connected to the network and assembled to a T-shaped part 24 by means of a union-nut of the kind illustrated in Figure 3, a closure 25 based on the same principle as the member 6 in Figure 4 being provided on the opposite side of the part 24.

The T-shaped part 24 is connected to a cross-like part 27 by a pipe 26 coupled to the parts 24 and 27 in the same manner as the supply pipe 23 is coupled to part 24.

This cross-like part 27 supplies compressed air to a central distributing space 30 of the distributor 21 through the intermediary of a reduction coupling 28 similar to that shown in Figure 4, and a pipe 29. The latter is connected to the inlet of the central space 30 through the medium of a coupling 31 similar to that shown in Figure 3, but in which the female member has a threaded neck 32 which screws into the distributor body. The coupling connecting the supply pipes 33 and 34 of the pneumatic cylinder (not shown) are the same as the aforesaid coupling 31 and communicate with the central space 30, as shown at 35.

The cross-like part 27 is also intended to supply compressed air to the relay valves 22 through reduction couplings 36, pipes 37 and couplings 38 (of the kind shown in Figure 3) of which the female member constitutes an integral part of the valve body.

The closure 25 is adapted to enable checking of the pressure in the pipe system, and also, if desired, to permit the measurement of this pressure.

To this end, the closure is provided with a passage 39 opening into the groove formed between its inner annular sealing lip and its outer threaded skirt. This passage is sealed off when the closure is screwed home, due to the sealing action of the annular lip and also to the fact that it engages the front edge or face of the female member which constitutes a stop limiting the screwing of the closure as in the case of the coupling member 19 illustrated in Figure 4. Thus, when the closure is partially unscrewed until the sealing action of the lip is broken, air under pressure is allowed to escape through the passage 39. This very simple arrangement may prove extremely useful when checking or investigating the operating conditions of a distribution plant, or tracing the cause of failures.

Figure 6 illustrates a cock or valve for use in a pipe or hose fluid distribution line. The cock or valve comprises a female member 41 made of plastics material constituting the valve body and comprising an inlet 42 adapted to be secured by screwing on the supply pipe or hose. The female member 41 comprises a cylindrical bore 44 in which a plug-like male member 45 made of plastics material is adapted to slide. The male member is formed at its leading end with an annular sealing lip 46 adapted, when the male member is fully inserted in the female member, to engage a frusto-conical seat 43 in the female member. The male member 45 can slide in a fluid-tight manner in the bore 44, a toroidal resilient gasket 47 being provided to this end.

Axial movement of the male member 45 is obtained with the assistance of a knurled or milled union nut 48 screwed on the threaded end 49 of the female member 41. This union nut 48 is provided for this purpose with an inner flange 50 locked between a shoulder 51 of the male member 45 and a nut 52 which in this case, is fitted by resilient deformation and retained in an annular groove 53.

When the union nut 48 is tightened, the lip 46 of the male member 45 engages the frusto-conical surface 43 and becomes slightly curved inwards, as shown in the figure, to seal the passage under the conditions set forth hereinabove. It will be seen that any undue over-tightening of the male member 45 in the closing direction is avoided since the flange 50 of the union nut is adapted to engage the female member 41 when the male member 45 is properly seated, that is when the annular lip 46 is in proper sealing en-

gagement with the seat 43. Of course, as the union nut 48 and the male member 45 move axially together, this tightening limitation may be obtained by positively stopping the male member as illustrated in Figures 7 and 8.

The male member 45 is advantageously formed with an orifice 54 into which can be screwed an outlet hose, this orifice communicating through radial ports 55 with an annular space 56 which surrounds the front end of the male member 45 and which, when the male member is fully inserted into the female member, is sealed off by the flexible lip 46 from the inlet 42.

When the union nut 48 is sufficiently unscrewed to cause disengagement between the sealing lip 46 and the seat-forming frusto-conical surface 43, the fluid introduced in the direction of arrow 57 will penetrate into the annular space 56 and subsequently flow through the radial ports 55 into the outlet pipe (not shown) connected to the male member at 54.

The overall length of the cock or valve is thus variable, which is permissible provided that at least the hose or pipe connected at 54 is flexible. Besides, a radial passage 58 is formed through the wall of the union nut 48 so that the presence of fluid in the pipe system may be detected before unscrewing the union nut 48 completely. To this end the male member is adapted to leave the bore 44 and to register with a counter bore 59 formed in the female member 41 to enable the inlet 42 to communicate with the passage 58 before the union nut 48 is fully unscrewed.

Of course, this form of embodiment may also constitute an end cock or valve, and the inlet 42 may also be positioned at right angles to the outlet 54.

Figure 7 is an axial section illustrating a cock or valve similar in design and made of similar material to that of Figure 6 and which is particularly suitable for mounting between aligned fixed pipes.

The female member 41 comprises in this case an inlet 60 and an outlet 61, the latter communicating permanently with a space 56 surrounding the front portion of the male member 45, the sealing function and operation of this male member being those already described in connection with the embodiment of Figure 6.

In other installations it may be advantageous to have a cock or valve which can be mounted on the ends of two fixed pipes disposed at right angles to one another, in order to avoid the use of a separate fitting, and Figure 8 illustrates such a cock or valve similar in design and made of similar material to that of Figure 6 whose inlet and outlet orifices are designated by 60 and 61 respectively.

WHAT WE CLAIM IS:—

1. A fitting for use in fluid distribution systems including pipes, tubes and/or hoses, said fitting comprising a female member and formed with a frusto-conical seat surface, a male member made of plastics material and having a flexible annular end portion terminating in a bevelled annular lip freely engageable with said seat surface, said lip having a free end adapted to abut axially against an intermediate portion of said seat surface, and tightening means for coupling said members and simultaneously subjecting the lip to an elastic flexion with the end of said lip being constricted in a sealing relationship by and with the seat surface.

2. A fitting according to Claim 1, wherein said male member comprises an external shoulder forming a stop for engagement by an assembling nut which constitutes said tightening means and which is adapted to be screwed on the female member.

3. A fitting according to Claim 2, particularly for coupling two lengths of hose made of plastics material wherein at least the male member has a hose-connecting collar to which one of said lengths of hose can be secured by adhesive substance, said collar being formed with circular grooves in which the adhesive substance, when applied and when set, forms hose-retaining beads.

4. A fitting according to Claim 1, wherein the male member is provided with a collar surrounded by a nut which constitutes said tightening means and which screws on the female member and said male member has, at its end opposite the end adapted to be inserted into the female member, a female extension of reduced diameter.

5. A fitting according to Claim 1, wherein said male member defines a plug, and said tightening means includes a threaded nut portion adapted to be screwed onto the female member, said male member having a discharge orifice leading into a groove formed within said nut portion.

6. A fitting according to any preceding claim, wherein the front edge of the female member is adapted to abut against a part of the male member when tightening said means to locate said members in the optimum sealing position of the lip end against the seat surface.

7. A fitting according to Claim 1 for coupling two lengths of flexible hose made of plastics material, wherein the male member is constituted by one end portion of one of said lengths of hose, said end portion being swelled with the assistance of an externally convex annulus which is fully inserted into said end portion to provide said free annular lip which is adapted to be pressed into engagement with said seat surface with the assistance of a union-nut carried by said one of said lengths of hose and adapted to engage said swelled end portion and to be screwed

onto the female member, said union-nut constituting said tightening means.

8. A valve fitting according to Claim 1, wherein the female member constitutes a valve body which has an inlet and which is provided with said frusto-conical seat surface, the male member constituting a plug fitting in a fluid-tight manner and slidably in a bore constituting the central chamber of the valve body, said plug being actuatable by means of a union-nut screwed on the valve body and constituting said tightening means, means being provided for rendering said nut and plug axially fixed with respect with each other.

9. A valve fitting according to Claim 8, wherein means are provided for limiting the tightening of the plug to the optimum position of the annular sealing lip end relative to the seat surface when closing the valve, said nut and plug abutting against the valve body in this optimum position.

10. A valve fitting according to Claim 8 or 9 for connection in a flexible hose distributing line, wherein said plug is provided with an axial passage communicating with a chamber formed in the valve body between the bore in which the plug can slide in fluid-tight fashion and the sealing surface engaged by the annular lip on said seat, said axial passage constituting the outlet of the valve.

11. A valve fitting according to Claim 8, 9 or 10, wherein means are provided for checking the presence and pressure of fluid in the valve, said means consisting of a passage formed through the wall of the union-nut, said passage leading into the central chamber of the valve body before said union-nut is unscrewed completely, this feature being obtained by causing the sliding and fluid sealing portion of the plug to leave its bore after which it occupies a widened portion of the valve body.

12. A fitting for use in fluid distribution systems, substantially as hereinbefore described with reference to any one of the embodiments illustrated in the accompanying drawings.

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888143 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig.1

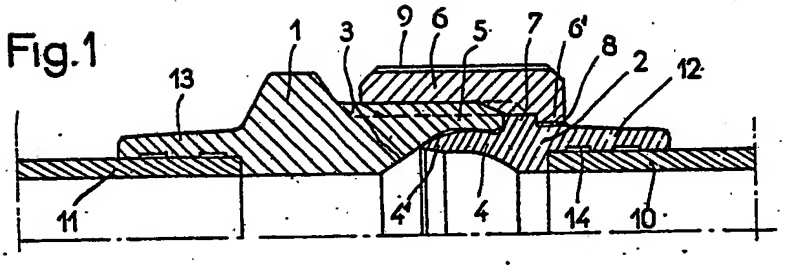

Fig.2

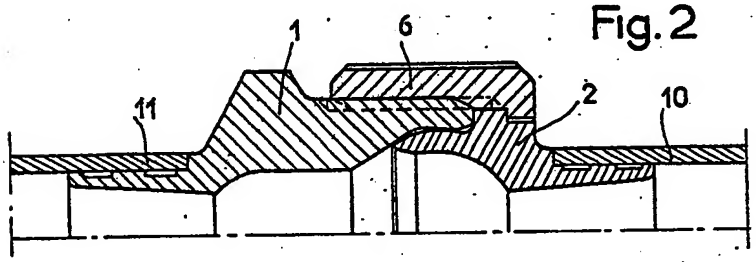

Fig.3

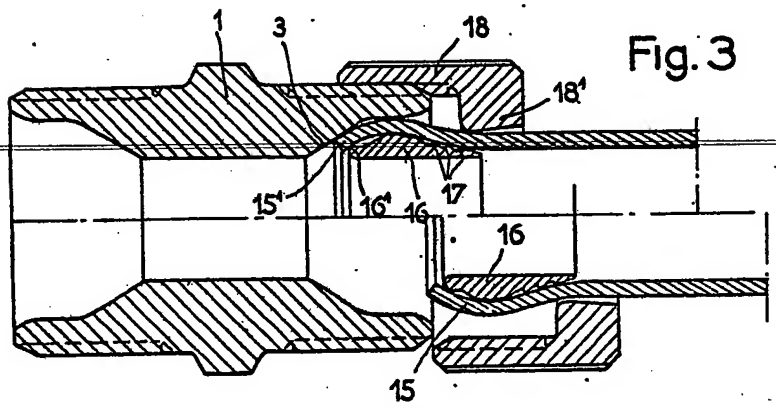

Fig.4

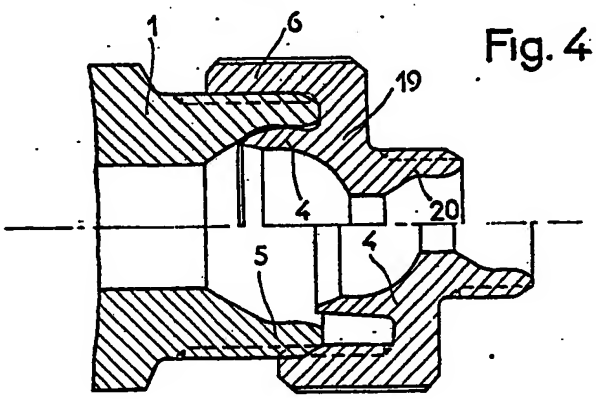

Fig.5

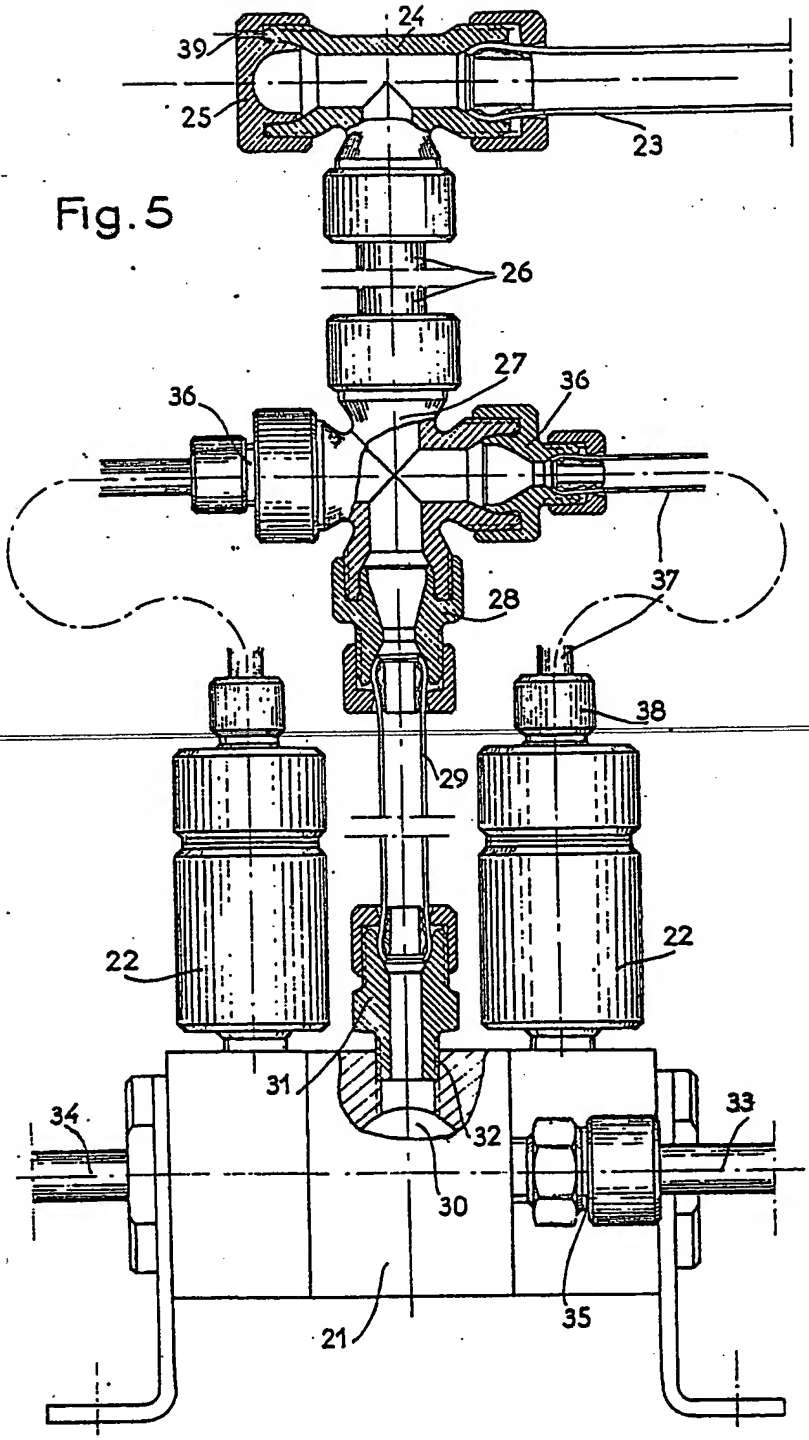

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Fig. 6

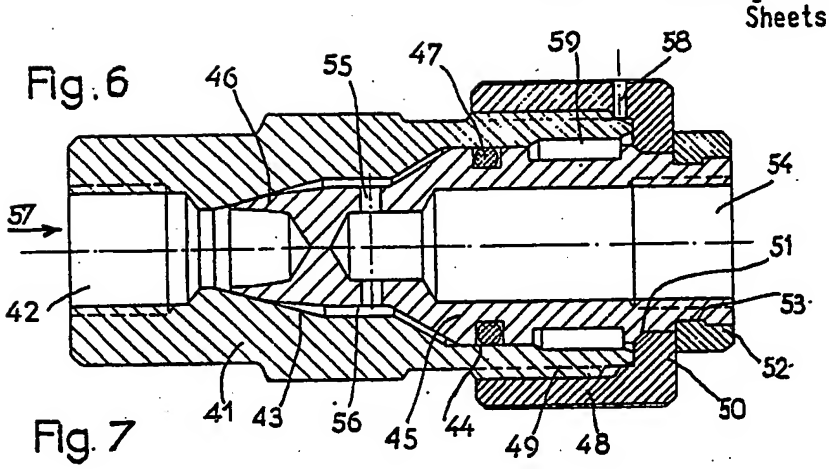

Fig. 7

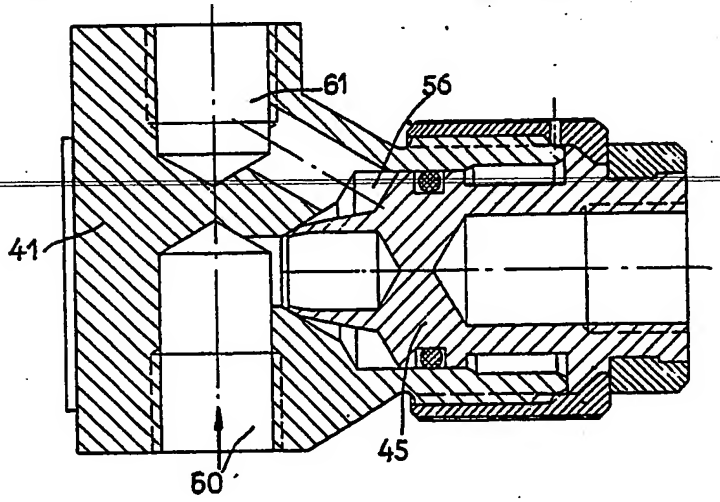

Fig. 8

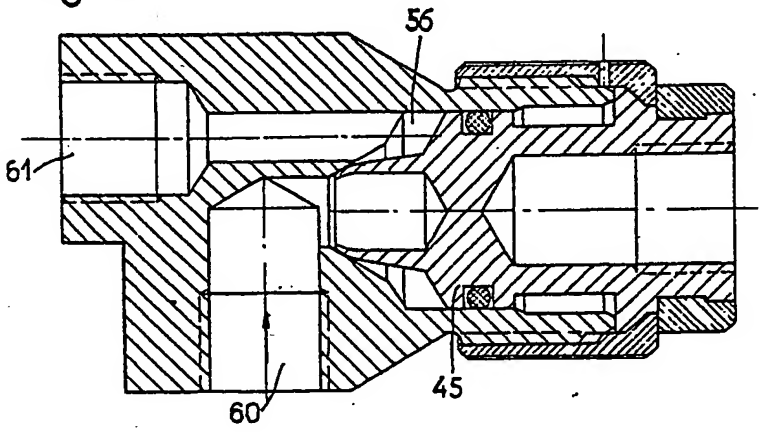

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Fig.5

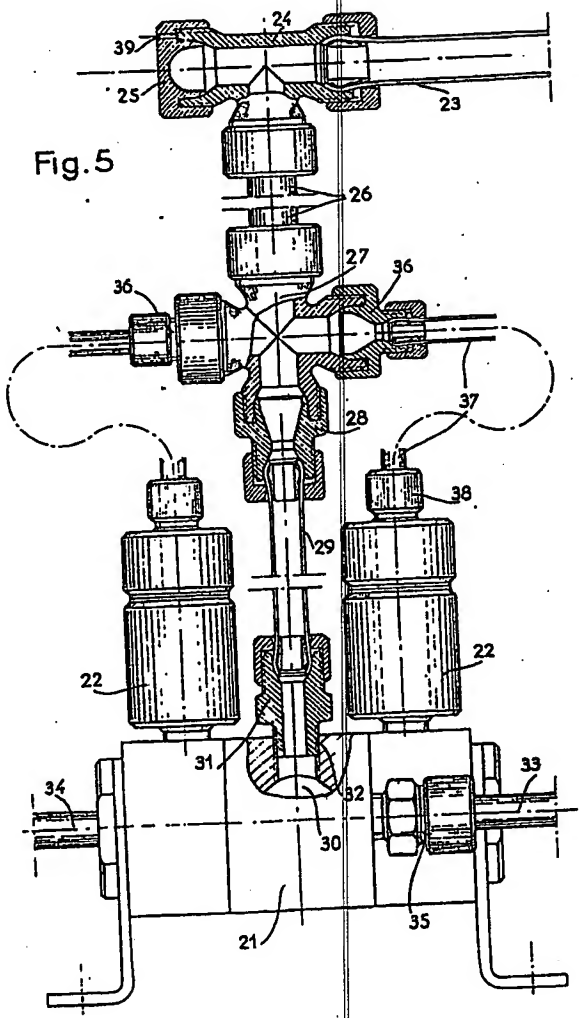

Fig.6

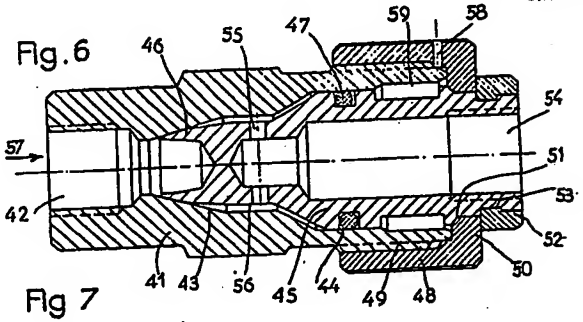

Fig 7

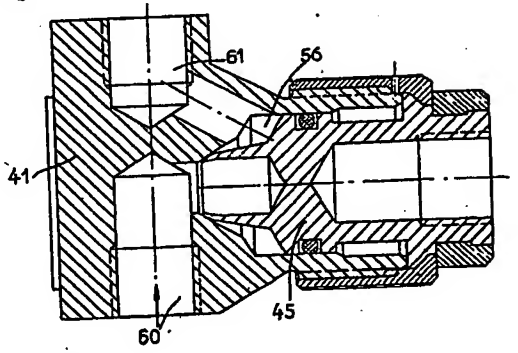

Fig. 8